

TECHNICAL MANUAL



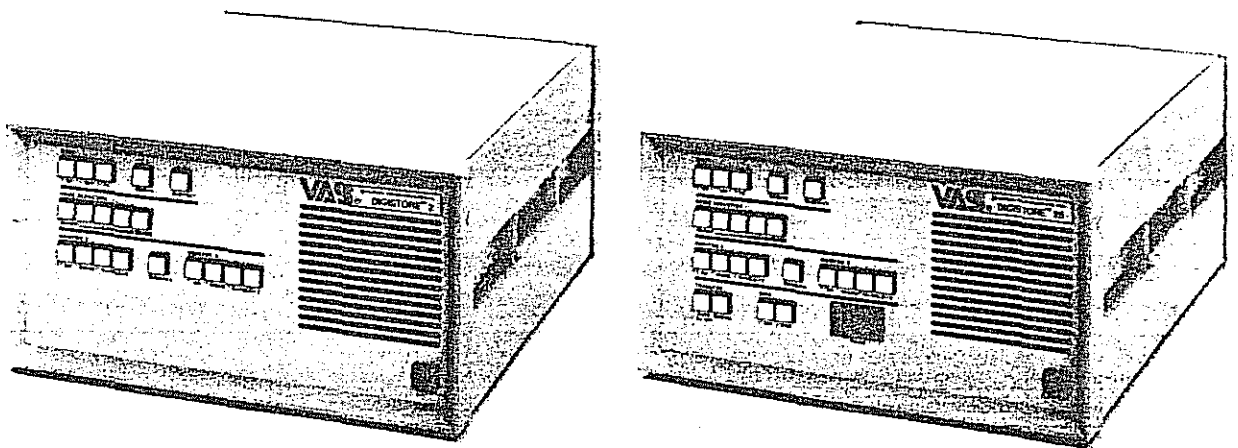
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SERVICE MANUAL

DIGITAL SCOPOFIX

DIGITAL SCOPOFIX DP DIGITAL SCOPOFIX DP/M

PEI 9807 717 90009 PEI 9807 717 40009



This manual contains information on the Digital Scopofix DP and DP/M to be used in Mobile Surgical X-ray System BV25.

Digital Scopofix DP is a dual solid state video memory for digital image recording and immediate replay of two video frames (625/525 lines, interlaced) with digital image processing for noise reduction.

Digital Scopofix DP/M includes all of the features as Scopofix DP and has also a Winchester disc memory for storage and retrieval of up to 25 video frame images copied from the dual solid state video memory.

IPC: Eindhoven

See cover sheets for dedicated information.

(83.0)

COVER SHEET DIGISTORE 1

July, 1983

This document is a general manual, not being updated to dedicated Philips requirements.

Additional dedicated information is presented on this cover sheet.

Digistore 1 is not supplied by Philips; all Digistore 1 information in following sections does not apply to Philips units:

INTRODUCTION, Functional specifications

CONTROL AND CONNECTORS, Pin callouts Digistore 1

OPERATING INSTRUCTIONS, Digistore 1

PARTS LIST AND DIAGRAMS; System block diagram Digistore 1

COVER SHEET : DIGISTORE 2 (Digital Scopofix DP)

July, 1983

This document is a general manual, not being updated to dedicated Philips requirements.

Additional dedicated information is presented on this cover sheet.

1. The following sections of manual do not apply to Philips units:

INTRODUCTION, FUNCTIONAL SPECIFICATIONS; Power up diagnostics: default is
2-ms time delay for Philips units
, EQUIPMENT REQUIRED/NOT SUPPLIED
INSTALLATION INSTRUCTIONS, RELAY INTERFACE INSTALLATION
, POWER CABLE
OPERATING INSTRUCTIONS, MODES OF OPERATION

NOTE

If installed in BV25 system, however, the mode descriptions may be useful in understanding the functions of the unit.

2. The following specifications differ:

- Video input : Video information up to 1.1 Volt (video only) will not be clipped off
- Video output : Video information up to 1.1 Volt will be available if applied to video input
- Safety : First units shipped may not be UL/CSA approved. Refer to labeling.
- Alignment procedures : Input video calibration of Video processor is adjusted for 1.1 Volt video and 0.3 Volt sync.

COVER SHEET DIGISTORE 25 (Digital Scopofix DP/M)

July, 1983

This document is a general manual, not being updated to dedicated Philips requirements.

Additional dedicated information is presented on this cover sheet.

1. The following sections of manual do not apply to Philips units:

INTRODUCTION, FUNCTIONAL SPECIFICATIONS, Power up diagnostics: default is
2-ms time delay for Philips units
, EQUIPMENT REQUIRED/NOT SUPPLIED
INSTALLATION INSTRUCTIONS, RELAY INTERFACE INSTALLATION
, POWER CABLE
OPERATING INSTRUCTIONS, MODES OF OPERATION

NOTE

If installed in BV25 system, however, the mode descriptions may be useful in understanding the functions of the unit.

2. The following specifications differ:

- Video input : Video information up to 1.1 Volt (video only) will not be clipped off.
- Video output : Video information up to 1.1 Volt will be available if applied to video input
- Safety : First units shipped may not be UL/CSA approved. Refer to labeling.
- Alignment procedures : Input video calibration of Video processor is adjusted for 1.1 Volt video and 0.3 Volt sync.

COVER SHEET

DIGISTORE 2 INSTALLATION/OPERATING INSTRUCTIONS

March 10, 1983

This document is a general manual, not being updated to dedicated Philips requirements.

Additional dedicated information is presented on this cover sheet.

1. The following sections of Manual do not apply to Philips units:

"EQUIPMENT REQUIRED/NOT SUPPLIED"

"RELAY INTERFACE INSTALLATION"

"POWER CABLE"

"MODE DESCRIPTIONS"

If installed in BV 25, however, the mode descriptions may be useful in understanding the functions of the unit.

2. The following specifications differ:

Video input: Video information up to 1.1 volt (video only) will not be clipped off.

Video output: Video information up to 1.1 volt will be available if supplied to video input.

UL/CSA: First units shipped may not be approved. Refer to labeling.

COVER SHEET

DIGISTORE 25 INSTALLATION/OPERATING INSTRUCTIONS

March 10, 1983

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If installed in BV 25, however, the mode descriptions may be useful in understanding the functions of the unit.

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Video output: Video information up to 1.1 volt will be available if supplied to video input.

UL/CSA: First units shipped may not be approved. Refer to labeling.

TABLE OF CONTENTS

Page No.

INTRODUCTION

Unpacking and Inspection.....	E-1
Site Location.....	E-1
Equipment Supplied.....	E-1
Equipment Required/Not Supplied.....	E-1
Functional Specifications.....	E-3

SECTION 1 - CONTROLS AND CONNECTORS

Front Panel Controls.....	1-1
Rear Panel Controls.....	1-3
Digistore 1 Pin Callouts.....	1-5
Digistore 2 Pin Callouts.....	1-6
Digistore 25 Pin Callouts.....	1-7

SECTION 2 - INSTALLATION

Test Equipment.....	2-1
Relay Interface Installation.....	2-1
Power Cable.....	2-2
Power and Signal Cabling Installation.....	2-3

SECTION 3 - OPERATION

Introduction.....	3-1
General Description.....	3-1
Modes of Operation.....	3-1
Functions.....	3-6
Disc Drive Operation (DS 25 recorders only).....	3-7

SECTION 4 - THEORY OF OPERATION

General Description.....	4-1
Circuit Description.....	4-3

SECTION 5 - SERVICE AND MAINTENANCE

Alignment Procedures.....	5-1
Troubleshooting.....	5-3

TABLE OF CONTENTS
(continued)

	Page No.
SECTION 7 - PARTS LISTS AND DIAGRAMS	
Replacement Parts Diagram.....	6-1
System Block Diagram, Digistore 1.....	6-2
System Block Diagram, Digistore 2.....	6-3
System Block Diagram, Digistore 25.....	6-4
Block Diagram, Video Input.....	6-5
Block Diagram, Video Output.....	6-6
Block Diagram, System Controller.....	6-7
Block Diagram, Arithmetic Logic Unit.....	6-8
Block Diagram, Phase Lock Loop.....	6-9
Block Diagram, Memory.....	6-10
Block Diagram, Buffer Memory.(DS 25 recorders only).....	6-11
Wiring Diagram, System Power.....	6-12

INTRODUCTION

UNPACKING AND INSPECTION

Carefully open the instrument shipping carton, remove the instrument from the carton and inspect for evidence of physical damage such as scratched panel surfaces, broken knobs, dented case, etc. If there are any signs of damage, immediately notify the shipping agent and VAS Corporation.

SITE LOCATION

Install the Digistore Recorder in a well-ventilated area.

The Digistore Recorder must be installed on a solid-based, horizontal, level surface, such as a table, shelf, or instrument cart with all four wheels in firm contact with the floor.

EQUIPMENT SUPPLIED

The following equipment is supplied:

One Digistore Recorder

One Power Cord (if on purchase order)

One Technical Manual

One User's Guide

The bill of materials packed with the Recorder identifies the equipment ordered.

EQUIPMENT REQUIRED/NOT SUPPLIED

To provide for use of the Last Image Hold feature, a time delay circuit must be furnished by the X-ray manufacturer to delay termination of the X-ray for a short period of time (minimum of 80 milliseconds on 50 Hz units and 68 milliseconds on 60 Hz units) after the footswitch is released. This delay allows the Recorder to record the last image after footswitch release. The delay should be set as short as possible to avoid unnecessary radiation, but not less than specified above.

WARNING

The method used to provide delay must be such that a component failure will not cause X-ray actuation.

FUNCTIONAL SPECIFICATIONS

Number of Images stored: DS 1: One frame or two fields in solid state memory.
DS 2: Two frames in solid state memory
DS 25: Two frames in solid state memory; 25 frames on disc.

Image format: 640 x 512 x 8 bit.

Memory depth: Frame store: 10 bit.
Winchester Disc Drive: 8 bit.

Video input requirements: 1.0 volt peak-to-peak (or other as specified) composite video signal, 75-ohm termination; RS-170 or CCIR compatible. If video input exceeds specified input, peak whites will be clipped off.

Analog to digital converter: 8 bit.

Sampling rate: NTSC: 12.096 MHz.
CCIR: 12.000 MHz.

Video output: Number of independent video outputs: one or two, each with 1 volt peak-to-peak (or other as specified) composite video signal, 75-ohm termination.

Video bandwidth: -3 dB point at 4.2 MHz.

Signal-to-noise ratio: Better than 54 dB.

Digital-to-analog converter: 8 bit.

Record format: DS 1: One frame or two fields are stored electronically in solid state memory.
DS 2 & 25: One video frame in each solid state memory.

Arithmetic processing: Available for all frames during record.

Storage media: 64K dynamic access memory.

Electrical: 90-132 or 180-250 volts AC, 47-63 Hz.
User selectable on back panel.

Control logic: Microprocessor controlled, TTL compatible.
Most functions have remote capability.

Controls: MODE Switches: ER, LIH, FL, REC/BSY
NOISE REDUCTION Switches: ON/OFF, (• • • •)
MONITOR 1: ON, FRM, FLD 1, FLD 2
SEQ (DS 2 and 25 only)
MONITOR 2: ON, FRM, FLD 1, FLD 2 (DS 2 & 25 only)

FUNCTIONAL SPECIFICATIONS
(Continued)

Disc Drive Specifications
(Digistore 25 only)

Controls:	TRANSFER: AUTO, MAN DISC: REV, FWD TRACK Indicator
Disc Speed:	Approximately 3600 RPM.
Disc Motor:	DC brushless.
Access time to disc image:	Approximately 2 seconds.
Data transfer time of frame to disc image	Approximately 2 seconds.
Transfer from Frame Store to Disc:	Manual or Automatic.
Disc Drive Reliability:	Better than 10,000 power-on hours.

FUNCTIONAL SPECIFICATIONS
(Continued)

Safety: Unit will meet UL, CSA, IEC, and VDE safety standards.

Environmental: Operating Temperature: 0°C to 40°C.

Relative Humidity: 80% maximum,
non-condensing.

Size: Width - 17" (431.8 mm)
Depth - 23" (584.2 mm)
Height - 9.1" (222.25 mm)

Mounting: Rack or table.

Power Up Diagnostics: Battery Check: The battery voltage is always compared with a threshold value of 2.3 volts. On power up, if the battery voltage has fallen below 2.3 volts, the output of a comparator goes low, indicating "battery failure" or "battery marginal". This output of the comparator is monitored by the controller, and instead of going through all the normal initializations, it outputs a pattern of lights on the front panel. The user will first notice that all the lights on the front panel turn on and then off, and then that the Noise Reduction lamp and the number 8 (third highest) noise reduction value lamp will be lit, indicating battery failure. The user can continue normal operation by pressing the Noise Reduction ON/OFF Switch. The front panel will assume the setup selected before unit was turned off, providing the RAM is operational (remember variables), or a default setup.

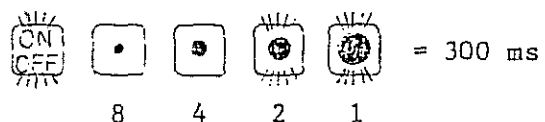
Fifty/Sixty Check If the incoming video is 50 Hz and the switch on the rear panel is set for 60 Hz, normal initializations will not be started. The user will notice all lamps turn on, then turn off, then the Noise Reduction ON/OFF lamp and number 16 (highest) Noise Reduction value lamp will be lit, warning the user of the wrong setup. The user can then either change the video or the switch on the rear panel and resume normal operation by pressing the Noise Reduction ON/OFF switch.

Changing the Delay: To change the time delay, the ER, LIH, and FL switches must be pressed simultaneously. These three lamps will light, all other lamps will go out, indicating entrance into the test cycle. Then the LIH switch must be pressed; the LIH lamp will go out, indicating that the configuration mode has been entered. The highest noise reduction value switch (largest dot) is pressed (lamp will light) to select the delay mode. To actually enter the delay mode, the Noise Reduction ON/OFF switch must be pressed. The Noise Reduction ON/OFF lamp will light and the highest noise reduction value lamp (largest dot) will go out, indicating that the delay mode is active. At this point the delay value can be examined as well as changed. Pressing the FRM 1 switch will display the hundreds (milliseconds) value of the delay in BCD on the noise reduction value lamps. The delay can be changed directly by entering a new value with the appropriate noise reduction value switch. Similarly, the tens and ones values of the delay may be examined by the FLD 1 and FLD 2 switches respectively and may be changed similarly.

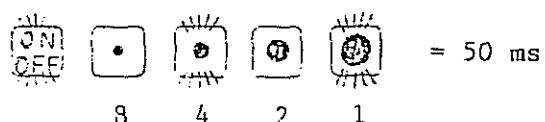
To exit the test mode, the ER, LIH, and FL switches must again be pressed simultaneously.

Example: Time delay of 352 milliseconds set in BCD (Binary Coded Decimal):

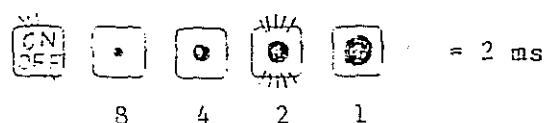
FRM 1 = hundreds



FLD 1 = tens



FLD 2 = ones



NOTE: Time delays set above 999 will not be retained upon power down; delay will default to original factory setting.

CONTROLS AND CONNECTORS

FRONT PANEL

<u>NAME</u>	<u>DESCRIPTION</u>
-------------	--------------------

MODE SELECTIONS

ER	Places the recorder in the ER (Electronic Radiography) mode of operation. Electronic Radiography is a means of minimizing the X-ray exposure required to record an image. Stepping on the footswitch energizes the X-ray and initiates a recording. Upon completion of the recording, X-ray is automatically terminated although the footswitch remains depressed. The recorded image is displayed from the selected memory (Monitor 1 or 2).
----	---

LIH	Places the recorder in the LIH (Last Image Hold) mode of operation. Last Image Hold is a means of viewing a live fluoroscopic image while pressing the footswitch, and recording an image when the footswitch is released. The recorded image is displayed from the selected memory (Monitor 1 or 2).
-----	---

FL	Places the recorder in the FL (Fluoroscopic) mode of operation. Fluoro is a means of viewing a live fluoroscopic image while pressing the footswitch, without recording an image. Images can be recorded by pressing "REC/BSY" while the footswitch is depressed.
----	---

SUB	Places the recorder in the SUB (Subtract) mode of operation. Subtract is a means of visualizing and recording the "difference" between two selected images. Pressing SUB also causes the automatic selection of Monitor 2, the monitor on which the first image or "mask" is to be recorded.
-----	--

REC/BSY	REC/BSY (Record/Busy) is a manual recording command, operational in any of the above modes. The REC/BSY lamp lights steady during recording process and while X-ray is actuated.
---------	--

NOISE REDUCTION

ON/OFF	Turns on or off Noise Reduction feature. Noise Reduction is available in all modes to reduce random noise.
--------	--

Pressing Noise Reduction value switches increases noise reduction, smoothing the recorded image. In the ER mode, X-ray exposure time will increase with increased noise reduction.

CONTROLS AND CONNECTORS

FRONT PANEL

<u>NAME</u>	<u>DESCRIPTION</u>
MONITOR (MEMORY) SELECTIONS	
ON	Determines into which memory the image is recorded and which monitor will display recorded image.
FRM	Selects Frame Mode of image display (one frame = two fields)
FLD 1/FLD 2	Selects Field Mode of image display (Viewing in the field mode reduces blurring due to image motion.) and determines which field will be displayed on selected monitor.
SEQ	Places the recorder in the Sequential Mode. Images are recorded and displayed alternately between Monitor 1 and Monitor 2.
DISC TRANSFER CONTROLS (Digistore 25 only)	
AUTO	Activates or deactivates Automatic Transfer. When Auto Transfer is activated (AUTO lamp lit), each image stored into the selected memory (Monitor 1 or Monitor 2) is also stored on the disc.
MAN	Manual Transfer. When Manual Transfer mode is activated (MAN lamp lit), an image is transferred from selected memory (Monitor 1 or Monitor 2) to disc by pressing this switch. NOTE: The Automatic and Manual Transfer modes are mutually exclusive. Pressing "AUTO" alternately places recorder into either the Automatic or Manual mode. The MAN switch is used only to transfer images, not to activate the Manual Transfer mode.
REV	Reverse stepping. Pressing this switch decrements the track counter at approximately two per second while the switch is pressed. Upon release of the switch, the image stored on the designated track is transferred to the selected memory (Monitor 1 or Monitor 2).
FWD	Forward stepping. Pressing this switch increments the track counter at approximately two per second while the switch is pressed. Upon release of the switch, the image stored on the designated track is transferred to the selected memory (Monitor 1 or Monitor 2).
TRACK	Indicates count of images transferred to the disc and/or track number of image transferred to selected memory (Monitor 1 or Monitor 2) from the disc.

CONTROLS AND CONNECTORS

REAR PANEL

<u>DESCRIPTION</u>	<u>FUNCTION</u>
VIDEO SIGNAL INPUT	The input video signal to the recorder is connected to this terminal. The impedance is 75 ohms and the signal level should be 1.1 volt peak-to-peak or as specified.
EXT. SYNC.	User optional feature. In situations where continuous video sync signal is not possible, or playback video is looped back to the input video, an external sync may be required.
VIDEO SIGNAL OUTPUT (1 & 2)	The output video signals to the monitors are connected to these terminals.
50/60 HZ	The position of this switch determines whether the video frequency of the recorder is to be 50 Hz or 60 Hz.
REMOTE CONTROL	The optional remote control is connected to this terminal.
INTERFACE	The electrical connections for the X-ray generator interface relays are connected to this terminal.
115V/220V	The position of this switch determines whether the voltage of the recorder is to be 115 or 220V.
MAINS POWER INPUT	The mains input power cable is connected to this terminal. Verify that the voltage select switch is set to the correct input voltage position.
F1 & F2	Two fuses are provided to protect both sides of the AC line. Replace only when necessary.

DIGISTORE 1 PIN CALLOUTS

REMOTE CONNECTOR

<u>Pin No.</u>	<u>Function</u>	<u>Pin No.</u>	<u>Function</u>
1	Cable Shield	20	+5V*
2	Gnd	21	Not available
3	ER	22	Not available
4	LIH	23	Not available
5	FLUORO	24	Not available
6	RECORD	25	Not available
7	Not available	26	Not available
8	NOISE REDUCTION	27	Not available
9	Weight #2	28	Not available
10	Weight #4	29	Not available
11	Weight #8	30	Not available
12	Weight #16	31	Not available
13	Frame	32	Not available
14	Field 1	33	Not available
15	Field 2	34	Gnd
16	DS Busy Indicator	35	Not used
17	Not available	36	Noise Reduction Indicator**
18	Not available*	37	Not used
19	Not used		

*1 AMP Max.

**Open Collector Outputs

INTERFACE CONNECTOR

<u>Pin No.</u>	<u>Function</u>	<u>Pin No.</u>	<u>Function</u>
1	Cable Shield	14	Not used
2	Not available	15	Not used
3	Not available	16	Not used
4	Not available	17	Not used
5	Not available	18	Not used
6	Not available	19	Not used
7	Not available	20	Not available
8	Start ¹	21	Not available
9	Start ¹	22	Bypass
10	Terminate ²	23	Not used
11	Terminate ²	24	Not used
12	Not used	25	Gnd
13	50/60 Hz Lo = 60 Hz		

NOTES:

1. 24V AC/DC Max.
2. Not polarity sensitive
3. Unused inputs shall not be terminated.

DIGISTORE 2 PIN CALLOUTS

REMOTE CONNECTOR

<u>Pin No.</u>	<u>Function</u>	<u>Pin No.</u>	<u>Function</u>
1	Cable Shield	20	+5V*
2	Gnd	21	Field 2, Monitor 1
3	ER	22	SEQUENCE
4	LIH	23	Monitor 2 Select
5	FLUORO	24	Frame, Monitor 2
6	RECORD	25	Field 1, Monitor 2
7	OPTION	26	Field 2, Monitor 2
8	NOISE REDUCTION	27	Not available
9	Weight #2	28	Not available
10	Weight #4	29	Not available
11	Weight #8	30	Not available
12	Weight #16	31	Not available
13	Monitor 1 Select	32	Not available
14	Frame, Monitor 1	33	Not available
15	Field 1, Monitor 1	34	Gnd
16	DS Busy Indicator	35	Not available
17	Not available	36	Noise Reduction Indicator**
18	Sequence Indicator*	37	Not used
19	Not used		

*1 AMP Max.

**Open Collector Outputs

INTERFACE CONNECTOR

<u>Pin No.</u>	<u>Function</u>	<u>Pin No.</u>	<u>Function</u>
1	Cable Shield	14	Not used
2	Not available	15	Not used
3	Not available	16	Not used
4	Not available	17	Not used
5	Not available	18	Not used
6	Not available	19	Not used
7	Not available	20	Not available
8	Start ¹	21	Not available
9	Start ¹	22	Bypass
10	Terminate ²	23	Not used
11	Terminate ²	24	Not used
12	Not used	25	Gnd
13	50/60 Hz Lo = 60 Hz		

NOTES:

1. 24V AC/DC Max.
2. Not polarity sensitive
3. Unused inputs shall not be terminated.

DIGISTORE 25 PIN CALLOUTS

REMOTE CONNECTOR

J1

<u>Pin No.</u>	<u>Function</u>	<u>Pin No.</u>	<u>Function</u>
1	Cable Shield	20	+5V*
2	Gnd	21	Field 2, Monitor 1
3	ER	22	SEQUENCE
4	LIH	23	Monitor 2 Select
5	FLUORO	24	Frame, Monitor 2
6	RECORD	25	Field 1, Monitor 2
7	OPTION	26	Field 2, Monitor 2
8	NOISE REDUCTION	27	Auto Transfer
9	Weight #2	28	Manual Transfer
10	Weight #4	29	Reverse Step
11	Weight #8	30	Forward Step
12	Weight #16	31	Count Up
13	Monitor 1 Select	32	Count Down
14	Frame, Monitor 1	33	Counter Reset
15	Field 1, Monitor 1	34	Gnd
16	DS Busy Indicator	35	Track Limit
17	Auto Transfer Indicator	36	Noise Reduction Indicator**
18	Sequence Indicator**	37	Not used
19	Not used		

*1 AMP Max.

**Open Collector Outputs

INTERFACE CONNECTOR*

J2

<u>Pin No.</u>	<u>Function</u>	<u>Pin No.</u>	<u>Function</u>
1	Cable Shield	14	Not used
2	Not available	15	Not used
3	Not available	16	Not used
4	Not available	17	Not used
5	Not available	18	Not used
6	Not available	19	Not used
7	Not available	20	Not available
8	Start ¹	21	Not available
9	Start ¹	22	Bypass
10	Terminate ²	23	Not used
11	Terminate ²	24	Not used
12	Not used	25	Gnd
13	50/60 Hz Lo = 60 Hz		

*If a special customer interface is required, this connector may be internal.
See Special Interface Callouts, Connector J-2A for external connections.

NOTES:

1. 24V AC/DC Max.
2. Not polarity sensitive
3. Unused inputs shall not be terminated.

INSTALLATION INSTRUCTIONS

TEST EQUIPMENT

Installation of the Digistore Recorder requires no special tools or test equipment.

RELAY INTERFACE INSTALLATION

One end of the 35-foot Relay Interface cable is fitted with a multi-pin connector. The relay circuit board is attached at the other end of the cable. To install the Relay Interface circuit board assembly, proceed as follows:

Standard Interface: Refer to paragraph A.

Custom Interface: Refer to paragraph B.

A. Standard Interface

X-ray generators with 24V dc power available, and which can withstand an extra load of 100 mA, can be connected directly to the Digistore Recorder through the Relay Interface circuit board.

1. Disconnect footswitch from X-ray generator.
2. Connect the X-ray equipment and footswitch to the relay interface as follows:

<u>TERMINAL LABELED</u>	<u>CONNECT TO</u>
-V	24V dc power supply negative (-).
+START	Red wire of VAS Interface Cable.
-START	Black wire of VAS Interface Cable.
TB25, TB26	At generator where original footswitch was disconnected in step 1 above.
FOOTSWITCH	Footswitch leads.
+V	24V dc power supply positive (+)
TERMINATE	Green and white wires of VAS Interface Cable.

3. Connect the 25-pin cable plug to the INTERFACE connector at the rear of the recorder.

B. Custom Interface:

When 24V dc is not available to operate the interface circuits, the Custom (Electronic Radiography) Interface is required. The Custom Interface is housed in a metal case.

Wiring connections between the relay circuit board and the footswitch and X-ray equipment are accomplished at terminals on the metal case. The Custom Interface contains a power supply and operates directly from 115V ac.

1. Disconnect footswitch from X-ray generator.
2. Connect X-ray equipment and footswitch to the relay interface as follows:

<u>TERMINAL LABELED</u>	<u>CONNECT TO</u>
115V AC IN	Hot side of 115V ac source.

NOTE

This power must be present whenever power is applied to the X-ray generator.

FOOTSWITCH	Footswitch (Disconnected in step 1).
X-RAY ON (2 terminals)	Terminals where footswitch was disconnected in step 1.

3. Connect the 25-pin cable plug to the INTERFACE connector at the rear of the recorder.

POWER CABLE

The Digistore Recorder is equipped with a three-conductor power cable which, when connected to an appropriate power outlet, grounds the instrument. The offset pin on the power cable three-prong plug is the ground pin.

WARNING

The power and ground connections must be correct, or a hazard will exist for the equipment operator, the patient, and other persons in the room.

POWER AND SIGNAL CABLING INSTALLATION

SPECIAL NOTE

The correct routing and termination of the video connecting cables is extremely important. Any 75-ohm video line must be terminated only one time and the termination must be at the destination end, not at an intermediate point of the line. For example, when connecting the recorder input to a line coming from the back of a video monitor loopthru connection, the monitor termination switch must be set in the high impedance position rather than the 75-ohm position.

If the recorder is later disconnected from the back of the video monitor, for proper operation of the video system without the disc recorder, the monitor termination switch must be returned to the 75-ohm position. The same is true of the recorder output. If it is desired to connect the recorder output to only one monitor, the monitor termination switch must be placed in the high impedance position; the video recorder will serve as the end-of-line termination.

Power and signal connectors are located at the recorder rear panel. Connect power and signal cables as follows:

1. Connect recorder power cable to recorder three-prong receptacle, and to power source outlet.
2. Connect monitor INPUT to recorder VIDEO OUT terminal(s).
3. Connect video signal source (camera) OUTPUT to recorder VIDEO IN terminal.

3. OPERATING INSTRUCTIONS

DIGISTORE 1 VIDEO RECORDER

1.0 INTRODUCTION

Operation of the Digistore 1 is straightforward and may be performed in a random sequence as may be required by the operator.

Actuation of the controls in any sequence or combination thereof will not cause damage to the equipment; however, recorded data can be erased or data not recorded as desired if the basic procedures are not understood and followed by the operator. To obtain maximum performance, reliability, and full use of the equipment capabilities, the operator should be familiar with the instructions presented in this manual.

2.0 GENERAL DESCRIPTION

The Digistore 1 Video Recorder is a solid state recording/playback system which for record and playback of still picture video images.

The Digistore 1 Recorder is designed for operation with any X-ray generator, including mobile "O.R." units, to record sequences of still video images for subsequent replay, study, and detailed analysis.

3.0 MODES OF OPERATION

The Digistore 1 has three modes of operation, Electronic Radiography, Last Image Hold, and Fluoroscopy. In addition, Noise Reduction, Frame/Field Select, and contrast control (optional) have been added for enhancement of operation.

During Power Up, the Digistore 1 will assume the ER mode of operation, with NOISE REDUCTION off, FRAME selected.

The record modes, Electronic Radiography (ER), Last Image Hold (LIH), and Fluoroscopy (FL) are mutually exclusive and merely entering one mode will cause the exiting of the other.

A. Electronic Radiography (ER)

Electronic Radiography, which can be used with any X-ray generator, is short-exposure fluoroscopy with simultaneous recording of a new single video still picture. Each actuation of the footswitch produces a new single-image recording. The VAS Interface circuit allows fluoroscopy exposure to continue only until the image is recorded, then automatically terminates the exposure even though the footswitch remains depressed. Exposure time is adjusted to obtain optimum quality recordings with minimum possible X-ray exposure time to the patient.

The Last Image Hold recording will operate with or without noise reduction. Without noise reduction, depression of the footswitch will put the recorder into the bypass mode for the duration of the footswitch closure and will store the next frame after footswitch release. With noise reduction, depression of the footswitch will cause a continuous averaging process per the selected weighting. Upon release of the footswitch, the averaging of the last sequence of images will be maintained in the selected memory.

To record and display images in the Last Image Hold mode, proceed as follows:

1. Select the LIH Mode (Press "LIH").
2. Select Noise Reduction if desired (Press "ON/OFF"). Select desired weighting value.
3. Select FRAME or FIELD mode (Press "FRM" or "FLD").

NOTE

Recordings can be made in either the FRAME or FIELD mode; however, for optimum resolution of playback images, select Frame mode (Press "FRM"). Selection of "FLD" 1 or "FLD 2" allows for display of each field ($\frac{1}{2}$ frame) separately.

4. Press footswitch to turn on X-ray and display live fluoroscopic image. Release of the footswitch completes recording sequence and terminates X-ray. The last image recorded will remain on the selected monitor.
5. Repeat Step 4 as necessary to record and display desired images.

Fluoroscopy

Recordings made in the Fluoroscopy (bypass) mode will be recorded into the memory, but will not appear on the monitor until recorder is switched to another mode of operation, such as ER.

To record in the Fluoroscopy mode, proceed as follows:

1. Select the Fluoroscopy mode (Press "FL")
2. Select Noise Reduction if desired (Press "ON/OFF"). Select desired weighting value.
3. Select FRAME or FIELD mode.

NOTE: For optimum resolution of playback images, select Frame Mode (Pre Fluoroscopy)

4. To make a recording, press footswitch. The X-ray will turn on and live fluoroscopy will be displayed on the selected monitor. Press "REC/BSY" to record the desired image into memory. The recorded image will remain in memory until replaced by a newly recorded image. Live fluoroscopy will continue to be displayed as long as the footswitch is pressed; the recorded image will not be displayed on the monitor. Release of the footswitch terminates X-ray.

4.0 FUNCTIONS

A. Noise Reduction (ON/OFF)

This function is available in the ER and LIH modes. When first activated following power up, the minimum weighting of 2 will automatically be assumed. Once a value of weighting is selected and a mode is exited, the same value will return upon re-entering the same mode and requesting noise reduction until a new value is selected.

In ER mode, the weighting represents the number of frames integrated.

In LIH mode, each incoming video frame is averaged with a stored frame. The relative value assigned to each frame is determined by the weighting value selected. The result of the last average remains in memory upon footswitch release.

B. Frame/Field Select (FRM/FLD)

Either the FRAME or FIELD mode can be selected for record or display of images.

Recording in the Field Mode allows for storage of two field images in memory which can be displayed separately by pressing FLD 1 or FLD 2; however, for optimum resolution, images should be recorded in the Frame mode.

Displaying images in the FIELD Mode reduces image flicker caused by motion.

C. Contrast Enhancement (optional)

The Contrast Enhancement control changes the weighting of the shades of gray to increase contrast of recorded images providing for more detailed viewing of specific areas.

OPERATING INSTRUCTIONS
DIGISTORE 2 VIDEO RECORDER

1.0 INTRODUCTION

Operation of the Digistore 2 is straightforward and may be performed in a random sequence as may be required by the operator.

Actuation of the controls in any sequence or combination thereof will not cause damage to the equipment; however, recorded data can be erased or data not recorded as desired if the basic procedures are not understood and followed by the operator. To obtain maximum performance, reliability, and full use of the equipment capabilities, the operator should be familiar with the instructions presented in this manual.

2.0 GENERAL DESCRIPTION

The Digistore 2 Video Recorder is a solid state recording/ playback system for storage and display of still picture video images.

The Digistore 2 Recorder is designed for operation with any X-ray generator, including mobile "O.R." units, to record sequences of still video images for subsequent replay, study, and detailed analysis.

3.0 MODES OF OPERATION

The Digistore 2 has four modes of operation, Electronic Radiography, Last Image Hold, Fluoroscopy, and Subtract (optional). In addition, Noise Reduction, Sequence, Frame/Field Select, and contrast control (optional) have been added for enhancement of operation.

During Power Up, the Digistore 2 will assume the ^{FL}~~ER~~ mode of operation, with SEQUENCE and NOISE REDUCTION off, FRAME and MONITOR 1 selected.

The record modes, Electronic Radiography (ER), Last Image Hold (LIH), Fluoroscopy (FL), and SUBTRACT (SUB), are mutually exclusive and merely entering one mode will cause the exiting of the other.

A. Electronic Radiography (ER)

Electronic Radiography, which can be used with any X-ray generator, is short-exposure fluoroscopy with simultaneous recording of a new single video still picture. Each actuation of the footswitch produces a new single-image recording. The VAS Interface circuit allows fluoroscopy exposure to continue only until the image is recorded, then automatically terminates the exposure even though the footswitch remains depressed. Exposure time is adjusted to obtain optimum quality recordings with minimum possible X-ray exposure time to the patient.

ER recording will operate with or without noise reduction. Without noise reduction, depression of the footswitch will cause a normal frame to be recorded in the selected memory at the end of the X-ray delay which allows for the image to become stable. If noise reduction is on, the recorded image will be an integration of the selected number of frames at the end of the X-ray delay.

To record and display images in the Electronic Radiography mode, proceed as follows:

1. Select ER Mode (press "ER").
2. Select Noise Reduction if desired (Press "ON/OFF"). Select desired weighting value.

NOTE

When selecting a higher weighting it should be noted that a result of increased noise reduction is increased X-ray exposure time and the possibility of image smear due to motion.

3. Select desired Memory (Press MONITOR 1 "ON", MONITOR 2 "ON, or "SEQ").

NOTE

Recordings will be made in the FRAME mode only, regardless of FRM/FLD selection; however, for optimum resolution of playback images, select the Frame mode (Press "FRM"). Selection of "FLD 1" or "FLD 2" allows display of each field ($\frac{1}{2}$ frame) separately and reduces blurring due to image motion.).

4. To make a recording, press the footswitch. X-ray will turn on, the image will be stored in the selected memory, X-ray will turn off, and the image will be displayed on the selected monitor.
5. Repeat Step 4 as necessary to record and display desired images.

Images will be stored and displayed through the selected Memory (Monitor 1 or 2). If "SEQ" (Sequence) has been selected, images will be recorded and displayed through both memories (Monitor 1 and 2) alternately, permitting observation of two different images simultaneously.

B. Last Image Hold (LIH)

Last Image Hold is automatic recording and replay of a single video image at the end of a period of live fluoroscopy; i.e., upon footswitch release.

When the footswitch is pressed, live fluoroscopy (bypass) is displayed on the selected video monitor. When the footswitch is released, the last video frame will be held in memory. The video monitor displays the stored image which may then be studied for as long as desired with no further patient exposure.

The Last Image Hold mode will operate with or without noise reduction. Without noise reduction, depression of the footswitch will place the recorder into the bypass mode for the duration of the footswitch closure and will store the next frame after footswitch release. With noise reduction, depression of the footswitch will cause a continuous averaging process per the selected weighting. Upon release of the footswitch, the averaging of the last sequence of images will be maintained in the selected memory.

To record and display images in the Last Image Hold mode, proceed as follows:

1. Select the LIH Mode (Press "LIH").
2. Select Noise Reduction if desired (Press "ON/OFF"). Select desired weighting value.
3. Select desired Memory (Press MONITOR 1 "ON", MONITOR 2 "ON", or "SEQ").

NOTE

Recordings will be made in the FRAME mode only, regardless of FRM/FLD selection; however, for optimum resolution of playback images, select Frame mode (Press "FRM"). Selection of "FLD 1" or "FLD 2" allows for display of each field ($\frac{1}{2}$ frame) separately.

4. Press footswitch to turn on X-ray and display live fluoroscopy. Release of the footswitch completes recording sequence and terminates X-ray. The last image recorded will remain on the selected monitor.
5. Repeat Step 4 as necessary to record and display desired images.

Images will be stored and displayed through the selected memory (Monitor 1 or 2). If "SEQ" (Sequence) has been selected, images will be recorded and displayed through both memories (Monitor 1 and Monitor 2) alternately, permitting observation of two different images simultaneously.

C. Fluoroscopy (FL)

The Fluoroscopic Mode is used for comparison of live fluoroscopy with previously recorded images and generally is not used for recording. The comparison image can be obtained in the ER, LIH, or FL modes.

Recordings made in the Fluoroscopy (bypass) mode will be recorded into the selected memory, but will not appear on the selected monitor until the recoder is switched to another mode of operation, such as ER or LIH.

To record in the Fluoroscopic Mode, proceed as follows:

1. Select the Fluoroscopic Mode (Press "FL").
2. Select Noise Reduction if desired (Press "ON/OFF"). Select desired weighting value.
3. Select desired Memory (Press MONITOR 1 "ON" or MONITOR 2 "ON").

NOTE

Recordings will be made in the FRAME mode only, regardless of FRM/FLD selection; however, for optimum resolution of playback images, select Frame Mode (Press "FRM"). Selection of "FLD 1" or "FLD 2" allows for the display of each field ($\frac{1}{2}$ frame) separately and reduces blurring due to image motion.

4. To make a recording, press footswitch. The X-ray will turn on and live fluoroscopy will be displayed on the selected monitor. Press "REC/BSY" to record the desired image into selected memory (Monitor 1 or 2). The recorded image remains in memory until replaced by a newly recorded image. Release of the footswitch terminates X-ray.

To display images recorded in the Fluoroscopic mode, proceed as follows:

1. Select Electronic Radiography or Last Image Hold Mode (Press "ER" or "LIH").
2. Select the Memory (Monitor 1 or 2) which was used to record images. Recorded image will be displayed on selected Monitor.

Comparative Fluoroscopy

To compare previously recorded images with live fluoroscopy, proceed as follows:

1. Record and display desired image.
2. Select other monitor.
3. Select Fluoroscopic Mode (Press "FL").
4. Press footswitch. X-ray will turn on; live fluoroscopy will be displayed on selected monitor and the previously recorded image will remain displayed on the other monitor. Release the footswitch to turn off X-ray.

D. Subtract (SUB)

The Subtract mode of operation allows for visualization and recording of the "difference" between a live image and a previously recorded image. A "mask" is recorded on Monitor 2 and remains displayed on Monitor 2 for reference. Incoming video is continuously subtracted from the mask, and the difference between the mask and the incoming video is displayed on Monitor 1.

NOTE

If there is no difference between the two images (incoming video and the previously recorded "mask") the display on Monitor 1 will be mid-gray.

To record and display images in Subtraction mode, proceed as follows:

1. Press "SUB" to place the recorder in the Subtraction mode. Monitor 2 will be automatically selected.
2. Select Noise Reduction if desired (Press "ON/OFF"), and desired weighting value (⊙ ⊗ ⊛ ⊞).
3. Record suitable mask by pressing footswitch, viewing live fluoroscopy and releasing footswitch when desired image is obtained.
4. Select Monitor 1. The Noise Reduction lamps will go off, as noise reduction is not functional during the subtraction process.
5. Press footswitch to provide continuous subtraction of live video from the recorded mask. The difference will be seen on Monitor 1. The mask will be seen on Monitor 2.
6. Release footswitch. the "difference" between the last subtracted image and the "mask" is stored in Memory 1 and is displayed on Monitor 1, while Monitor 2 continues to display the mask.

4.0 FUNCTIONS

A. Noise Reduction (ON/OFF)

This function is available in the ER and LIH modes, and while recording the "mask" portion of the SUBTRACT mode. When first activated following power up, the minimum weighting of 2 (the smallest dot) will automatically be assumed. Once a value of weighting is selected and a mode is exited, the same value will return upon re-entering the same mode and requesting noise reduction until a new value is selected.

In the ER mode, the weighting represents the number of frames integrated.

In LIH and SUBTRACT modes, each incoming video frame is averaged with a stored frame. The relative value assigned to each frame is determined by the weighting value selected. The result of the last average remains in memory upon footswitch release.

B. Sequence (SEQ)

This function can be requested in any mode other than SUBTRACT. When one of the frames is selected, it will automatically switch to the other frame upon completion of a record process on the previously selected frame. Upon entering the Sequence mode, Monitor 1 will automatically be selected.

C. Frame/Field Select (FRM/FLD)

During playback, either frame or field viewing can be selected on each monitor. Field viewing reduces image flicker caused by motion. The Digistore 2 will record in the frame mode only, regardless of frame/field selection.

D. Monitor Select (ON)

When either Monitor 1 or Monitor 2 is selected, subsequent operations of ER, LIH, or FL will be performed on the memory (monitor) which has been selected. Upon entering the SUBTRACT mode, Monitor 2 will automatically be selected for the "mask" recording; the "difference" recording will be displayed on Monitor 1.

OPERATING INSTRUCTIONS
DIGISTORE 25 VIDEO RECORDER

1.0 INTRODUCTION

Operation of the Digistore 25 is straightforward and may be performed in a random sequence as may be required by the operator.

Actuation of the controls in any sequence or combination thereof will not cause damage to the equipment; however, recorded data can be erased or data not recorded as desired if the basic procedures are not understood and followed by the operator. To obtain maximum performance, reliability, and full use of the equipment capabilities, the operator should be familiar with the instructions presented in this manual.

2.0 GENERAL DESCRIPTION

The Digistore 25 Video Recorder is a solid state recording/playback system which also employs a digital disc memory for storage and retrieval of up to 25 still-picture video images.

The Digistore 25 Recorder is designed for operation with any X-ray generator, including mobile "O.R." units, to record sequences of still video images for subsequent replay, study, and detailed analysis.

3.0 MODES OF OPERATION

The Digistore 25 has four modes of operation, Electronic Radiography, Last Image Hold, Fluoroscopy, and Subtract (optional). In addition, Noise Reduction, Sequence, Frame/Field Select, and contrast control (optional) have been added for enhancement of operation.

During Power Up, the Digistore 25 will assume the ER mode of operation, with SEQUENCE and NOISE REDUCTION off, FRAME and MONITOR 1 selected, and AUTO TRANSFER selected.

The record modes, Electronic Radiography (ER), Last Image Hold (LIH), Fluoroscopy (FL), and SUBTRACT (SUB), are mutually exclusive and merely entering one mode will cause the exiting of the other.

A. Electronic Radiography (ER)

Electronic Radiography, which can be used with any X-ray generator, is short-exposure fluoroscopy with simultaneous recording of a new single video still picture. Each actuation of the foot-switch produces a new single-image recording. The VAS Interface circuit allows fluoroscopy exposure to continue only until the image is recorded, then automatically terminates the exposure even though the footswitch may remain depressed. Exposure time is adjusted to obtain optimum quality recordings with minimum possible X-ray exposure time to the patient.

ER recording will operate with or without noise reduction. Without noise reduction, depression of the footswitch will cause a normal frame to be recorded on the selected memory at the end of the X-ray delay which allows for the image to become stable. If noise reduction is on, the recorded image will be an integration of the selected number of frames at the end of the X-ray delay.

To record and display images in the Electronic Radiography mode, proceed as follows:

1. Select ER Mode (press "ER").
2. Select Noise Reduction if desired (Press "ON/OFF"). Select desired weighting value.

NOTE

When selecting a higher weighting it should be noted that a result of increased noise reduction is increased X-ray exposure time and the possibility of image smear due to motion.

3. Select desired Memory (Press MONITOR 1 "ON", MONITOR 2 "ON", or "SEQ").

NOTE

Recordings will be made in the FRAME mode only, regardless of FRM/FLD selection; however, for optimum resolution of playback images, select the Frame mode (Press "FRM"). Selection of "FLD 1" or "FLD 2" allows display of each field ($\frac{1}{2}$ frame) separately.

4. If storage of multiple images is required, select Automatic Transfer (Press TRANSFER "AUTO"). Up to 25 images can be stored on the disc. The track display indicates the count of the last image transferred to the disc. To begin transferring from track 000, press and hold "REV" until the track display reads 000.

Images may also be recorded on the disc by Manual Transfer (Pressing "MAN").

5. To make a recording, press footswitch. X-ray will turn on, the image will be stored in the selected memory, X-ray will turn off, and the image will be displayed on the selected monitor. If Automatic Transfer ("AUTO") is selected, the image will also be transferred to the disc.

6. Repeat Step 5 as necessary to record and display desired images.

Images will be stored and displayed through the selected Memory (Monitor 1 or 2). If "SEQ" (Sequence) has been selected, images will be recorded and displayed through both memories (Monitor 1 and 2) alternately, permitting observation of two different images simultaneously. If AUTO Transfer is selected, each recorded image will be transferred to the disc, regardless of Monitor selection.

7. Images which have been transferred to disc may be reviewed by pressing "FWD" or "REV" and releasing switch upon reaching desired track. Release of "FWD" or "REV" initiates transfer of the image from the disc to the selected memory (Monitor 1 or 2) for viewing. A second image can be brought into the second memory for comparison by selecting the other monitor and pressing "FWD" or "REV" to reach the desired track.

B. Last Image Hold (LIH)

Last Image Hold is automatic recording and replay of a single video image at the end of a period of live fluoroscopy; i.e., upon footswitch release.

When the footswitch is pressed, a live fluoroscopy (bypass) image is displayed on the selected video monitor. When the footswitch is released, the last video frame will be held in memory. The video monitor displays the stored image which may then be studied for as long as desired with no further patient exposure.

The Last Image Hold recording will operate with or without noise reduction. Without noise reduction, depression of the footswitch will put the recorder into the bypass mode for the duration of the footswitch closure and will store the next frame after footswitch release. With noise reduction, depression of the footswitch will cause a continuous averaging process per the selected weighting. Upon release of the footswitch, the averaging of the last sequence of images will be maintained in the selected memory.

To record and display images in the Last Image Hold mode, proceed as follows:

1. Select the LIH Mode (Press "LIH".)
2. Select Noise Reduction if desired (Press "ON/OFF"). Select desired weighting value.
3. Select desired Memory (Press MONITOR 1 "ON", MONITOR 2 "ON" or "SEQ").

NOTE

Recordings will be made in the Frame mode only, regardless of FRM/FLD selection; however, for optimum resolution of playback images, select the Frame mode (Press "FRM"). Selection of "FLD 1" or "FLD 2" allows for display of each field ($\frac{1}{2}$ frame) separately.

4. If storage of multiple images is required, select Automatic Transfer (Press TRANSFER "AUTO"). Up to 25 images can be stored on the disc. The track display indicates the count of the last image transferred to the disc. To begin transferring from track 000, press and hold "REV" until the track display reads 000.

Images may also be recorded onto the disc by Manual Transfer (Press "MAN").

5. Press footswitch to turn on X-ray and display live fluoroscopic image. Release of the footswitch completes recording sequence and terminates X-ray. The last image recorded will remain on the selected monitor and will be transferred to disc if Automatic Transfer ("AUTO") is selected.
6. Repeat Step 5 as necessary to record and display desired images.

Images will be stored and displayed through the selected memory (Monitor 1 or 2). If "SEQ" (Sequence) has been selected, images will be recorded and displayed through both memories (Monitor 1 and Monitor 2) alternately, permitting observation of two different images simultaneously. If AUTO Transfer is selected, each recorded image will be transferred onto the disc, regardless of monitor selection.

C. Fluoroscopy (FL)

The Fluoroscopic Mode is used for comparison of live fluoroscopy with previously recorded images and generally is not used for recording. The comparison image can be obtained in the ER, LIH, or FL modes.

Recordings made in the Fluoroscopy (bypass) mode will be recorded into the selected memory, but will not appear on selected monitor until recoder is switched to another mode of operation, such as ER.

To record in the Fluoroscopic Mode, proceed as follows:

1. Select the Fluoroscopic Mode (Press "FL").
2. Select Noise Reduction if desired (Press "ON/OFF"). Select desired weighting value.
3. Select desired Memory (Press MONITOR 1 "ON" or MONITOR 2 "ON").

NOTE

Recordings will be made in the FRAME mode only, regardless of FRM/FLD selection; however, for optimum resolution of playback images, select Frame Mode (Press "FRM"). Selection of "FLD 1" or "FLD 2" allows display of each field ($\frac{1}{2}$ frame) separately.

4. If storage of multiple images is required, select Automatic Transfer (Press TRANSFER "AUTO"). The track display indicates the count of the last image transferred to the disc. To begin transferring from track 000, press and hold "REV" until track display reads 000.

Images may also be transferred onto the disc manually by Manual Transfer (Press "MAN").

5. To make a recording, press footswitch. The X-ray will turn on and live fluoroscopy will be displayed on the selected monitor. Press "REC/BSY" to record the desired image into selected memory (Monitor 1 or 2). The recorded image remains in memory until replaced by a newly recorded image or a previously recorded image transferred from disc. If AUTO Transfer is selected, each recorded image will be automatically transferred onto disc. Live fluoroscopy will continue to be displayed as long as the footswitch is pressed, and the recorded image will not be displayed on the selected monitor. Release of the footswitch terminates X-ray.

To display images recorded in the Fluoroscopic mode, proceed as follows:

1. Select Electronic Radiography or Last Image Hold Mode (Press "ER" or "LIH").
2. Select Memory (Monitor 1 or 2) which was used to record images. Recorded image will be displayed on selected Monitor.
3. To display images which have been transferred onto the disc, transfer desired images back to selected memory (See DISC/TRANSFER CONTROLS).

Comparative Fluoroscopy

To compare previously recorded images with live fluoroscopy, proceed as follows:

1. Record and display desired image, or transfer previously recorded image from disc to selected memory (See DISC/TRANSFER CONTROLS).
2. Select other monitor.
3. Select Fluoroscopic Mode (Press FL).
4. Press footswitch. X-ray will turn on; live fluoroscopy will be displayed on selected monitor and the previously recorded image will remain displayed on the other monitor. Release the footswitch to turn off X-ray.

D. Subtract (SUB)

The Subtract mode of operation allows for visualization of only subtracted materials and enables comparison of these images with earlier recordings.

To record and display subtracted images, proceed as follows:

1. Press "SUB" to place recorder in subtraction mode.
2. Select Monitor 2 for mask storage.
3. Select suitable mask either by pressing and releasing footswitch or by transferring a previously recorded image into Monitor.
4. Switch to Monitor 1.
5. Press footswitch to provide continuous subtraction of the mask from live video on Monitor 1, while the mask is displayed on Monitor 2.
6. Release footswitch. The last subtracted image is stored in Memory 1 and is displayed on Monitor 1, while Monitor 2 continues to display the mask.

4.0 FUNCTIONS

A. Noise Reduction (ON/OFF)

This function is available in the ER and LIH modes. When first activated following power up, the minimum weighting of 2 will automatically be assumed. Once a value of weighting is selected and a mode is exited, the same value will return upon re-entering the same mode and requesting noise reduction until a new value is selected.

In ER mode, the weighting represents the number of frames integrated.

In LIH and Subtract modes, each incoming video frame is averaged with a stored frame. The relative value assigned to each frame is determined by the weighting value selected. The result of the last average remains in memory upon footswitch release.

B. Sequence (SEQ)

This function can be requested in any mode other than SUBTRACT. When one of the frames is selected, it will automatically switch to the other frame upon completion of a record process on the previously selected frame. Upon entering the Sequence mode, Frame 1 will be automatically selected.

C. Frame/Field Select (FRM/FLD)

During playback, frame or field viewing can be selected individually on each monitor output to reduce image flicker caused by motion. The Digistore 25 will record in the frame mode only, regardless of frame/field selection.

D. Monitor Select (ON)

When either Monitor 1 or Monitor 2 is selected, subsequent operations of ER, LIH, or FL will be performed on the memory (monitor) which has been selected.

E. Contrast Enhancement (Optional)

The Contrast Enhancement controls (MONITOR 1 and MONITOR 2) change the weighting of the shades of gray to increase contrast of recorded images providing for more detailed viewing of specific areas.

5.0 DISC DRIVE OPERATION

A. Forward (FWD)

This setting increments the track counter at approximately two tracks per second while switch is pressed. Upon release of switch the image stored on designated track is transferred to the selected memory (MONITOR 1 or MONITOR 2).

B. Reverse (REV)

This setting decrements the track counter at approximately two tracks per second while switch is pressed. Upon release of switch the image stored on the designated track is transferred to the selected memory (MONITOR 1 or MONITOR 2).

C. Automatic Transfer (AUTO)

When Automatic Transfer is selected ("AUTO" lamp is lit) each image stored into selected memory (MONITOR 1 or MONITOR 2) is also stored onto disc.

D. Manual Transfer (MAN)

When Manual Transfer is selected ("MAN" lamp is lit) an image is stored on the disc from the selected memory (MONITOR 1 or MONITOR 2) only when "MAN" switch is pressed.

E. Track Indicator

The track indicator indicates the count of images transferred to the disc and/or track number of image transferred to selected memory (MONITOR 1 or MONITOR 2) from disc.

THEORY OF OPERATION

The DIGISTORE Series video memory systems provide still frame image storage capability. An input analog video signal is converted to a series of digital words, with values corresponding to the relative intensity of each sample position. Five hundred twelve horizontal lines are sampled six hundred forty times to transform one analog video frame into a 640 x 512 x 8 bit digital matrix; thus 327,680 samples are stored in a solid state memory during a record sequence. This same solid state memory can function as an image display memory by converting its digital words back to an analog video signal. Storage of an analog video frame in a digital matrix also permits digital video processing to be employed to modify the displayed image. Subtraction and noise reduction is accomplished digitally.

The DIGISTORE Series represents a fully integrated family of products. The DIGISTORE 1 contains a single 640 x 512 x 8 bit solid state memory for storage and a single analog video output for display. The DIGISTORE 2 has a second 640 x 512 x 8 bit solid state memory for storage of two images and two analog video outputs for display of both images simultaneously. The DIGISTORE 25 has the same dual memory and dual video output features as the DIGISTORE 2 plus a more permanent image storage capability utilizing a 5 $\frac{1}{4}$ -inch Winchester technology disc drive. Up to twenty five images can be stored on disc indefinitely and displayed by transfer back to either solid state memory. Other than the size of memory, all three configurations are identical.

The following list identifies the basic assemblies within the Digistore Series and briefly describes the function of each:

1. Video Processor - provides bypass video, analog-to-digital conversion, digital-to-analog conversion and output video drive.
2. Phase Lock Loop - generates all clocks and video timing signals in sync with input video timing signals.
3. Memory - stores 640 x 512 x 8 bits of digital video image.
4. Arithmetic Logic Unit - modifies the stored digital video image pixel by pixel to accomplish noise reduction and subtraction.
5. Buffer Memory (Digistore 25) - performs of digital video image transfer from memory to disc and from disc to memory.
6. Disc Assembly (Digistore 25) - provides peripheral storage of up to twenty-five digital video images.
7. System Controller - coordinates the functional operation of all assemblies.

CIRCUIT DESCRIPTION

Video Processor

The Video Processor performs conversion of the serial analog video stream to an eight-bit parallel digital video stream. This eight-bit parallel digital video stream is passed through the Arithmetic Logic Unit and is stored in memory during a record.

Composite sync is stripped from the input video and sent to the Phase Lock Loop for synchronizing the clocks and video pulse generator.

The Video Processor also performs conversion of the eight-bit parallel digital video stream stored in memory to a serial analog video stream for output.

In addition, power-off bypass and power-on bypass (Fluoroscopy) ^{live} are accomplished by the Video Processor.

Phase Lock Loop

The Phase Lock Loop provides clocks for timing digital functions and generates sync signals for reinsertion with the serial analog video stream output. Synchronization with the video source is maintained through either the external sync input or composite sync stripped from the input video on the Video Processor. The sync generator is programmed for 525/625 line sync by selecting 50/60 Hz on the rear panel.

Memory

Each memory contains solid state Dynamic Random Access Memory for image storage. Fifty 64K x 1 bit chips are configured in five rows (banks) ten bits wide. Memory mapping allows data storage with an 83-nsec (12 MHz) input data rate (Video Processor A/D sample rate) and a memory cycle time of 300 nsec (2.5 MHz). Field and line timing determine read/write addressing. A "Base Address" technique is employed to maintain proper vertical pixel addressing after digital video processing. The Memory contents are continuously read to the Video Processor and the Arithmetic Logic Unit.

Arithmetic Logic Unit

Digital video processing is performed in the Arithmetic Logic Unit. During a record without noise reduction, the eight-bit parallel digital video stream passes through the Arithmetic Logic Unit to the Memory with no changes. When Noise Reduction is selected, mathematical operations are performed on a pixel-by-pixel basis.

Recording in the Electronic Radiography mode with noise reduction incorporates an integration algorithm. Recording in the Last Image Hold with noise reduction incorporates a weighted average algorithm. The Subtraction mode requires data offset and scaling to retain full dynamic range.

Buffer Memory

The Buffer Memory is necessary for transfer of digital video images from memory to disc or from disc to memory because of the disc's slower data transfer rate. Memory operates at a 12-MHz rate and the disc operates at 625 KHz (5M bits/sec). The Buffer Memory contains dual buffers with a 24-line (640 samples/line) storage capability each. During transfer to Disc, the entire memory contents are cycled through the Arithmetic Logic Unit and back into memory. Twenty-four successive lines are read into alternating buffers during each pass. Each buffer is alternately read to disc until all 512 lines have been transferred.

Transfer from disc to memory also is done 24 lines at a time, alternately writing into each buffer from disc and alternately reading from each buffer to memory.

System Controller

The System Controller ties the functioning of all assemblies together in a logical fashion and provides the interface with the outside world through the front and rear panels. The System Controller outputs "Control Words" to the Video Processor, Arithmetic Logic Unit, Memory, and Buffer Memory to program operation of each device.

ALIGNMENT PROCEDURES

EQUIPMENT REQUIRED

Input video calibration, output video calibration, and video timing generator phasing are all factory adjustments requiring various specialized tools and test equipment including but not limited to the following:

1. Calibrated video source capable of providing a linear ramp and flatfield composite video signal of the proper field rate (50/60 Hz) and line rate (625/525 lines per frame).
2. Oscilloscope.
3. Digital voltmeter or digital multimeter.
4. Extender board (P/N 97200751)
5. One or two display monitors.
6. Alignment tool (flat blade)

All calibration is performed to specific video specifications as determined by overall system requirements. A failure of input or output video circuitry would normally be solved by replacement of the Video Processor Board and not by attempting a calibration.

VIDEO PROCESSOR ALIGNMENT

The following lists the procedure utilized in the factory for performing a complete video alignment and timing adjustment.

Input Video Calibration

1. Measure reference voltage at TP2 with a digital voltmeter for -2.5 VDC. Adjust R98 (reference voltage adjust) for -2.5 VDC if necessary. Verify that U14 pin 22 (A/D converter voltage reference input) measures -2.0 VDC.
2. Turn R122 (white peak clip) fully clockwise.
3. Connect a linearity ramp from the video source to the video input. Connect oscilloscope to TP5 and observe voltage of blanking portion of video waveform. If necessary, adjust R58 (A/D video DC adjust) to obtain zero volt blanking level.
4. Switch video source to flat field and adjust video source amplitude to desired clipping threshold (VAS standard is 0.7 volt video and 0.3 volt sync, while some special systems are adjusted for 1.1 volt video and 0.3 volt sync). Check A/D latch (U21) output pins 3, 5, 7, 9, 12, 14, and 16 for a high (+5V) condition and verify that pin 18 is alternating between a high (5V) and a low (0V) during active line time. If necessary, adjust R57 (A/D video gain) to achieve the above conditions. NOTE: Peak white observed at TP5 should be -2.0V (The video is seen inverted).

5. Observe sync tip level of composite video waveform at TP5 for +200 mV. Adjust R111 (black peak clip) if necessary.
6. Record into both memories and verify the input levels on both D/A latch inputs. Observe the following inputs for a high (+5V): U16, U17, U18, and U19, pins 15, 10, 7, and 2. U17 and U19, pins 2 may be alternating between a high (+5V) and a low (0V).

Output Video Calibration

1. Perform the following operations, in the order shown, on Video 1, then repeat the adjustments on Video 2.

<u>Parameter</u>	<u>Mode</u>	<u>Output Adjustment</u>	
		<u>Video 1</u>	<u>Video 2</u>
(a) Output blanking = low (0V)	ER	R3	R26
(b) Output video amplitude = clipping threshold	ER	R9	R27
(c) Output sync amplitude = .3V	ER	R12	R31
(d) Output blanking = low (0V)	FLUORO	R44 (balance)	R44
(e) Output amplitude = clipping threshold	FLUORO	R17	R37

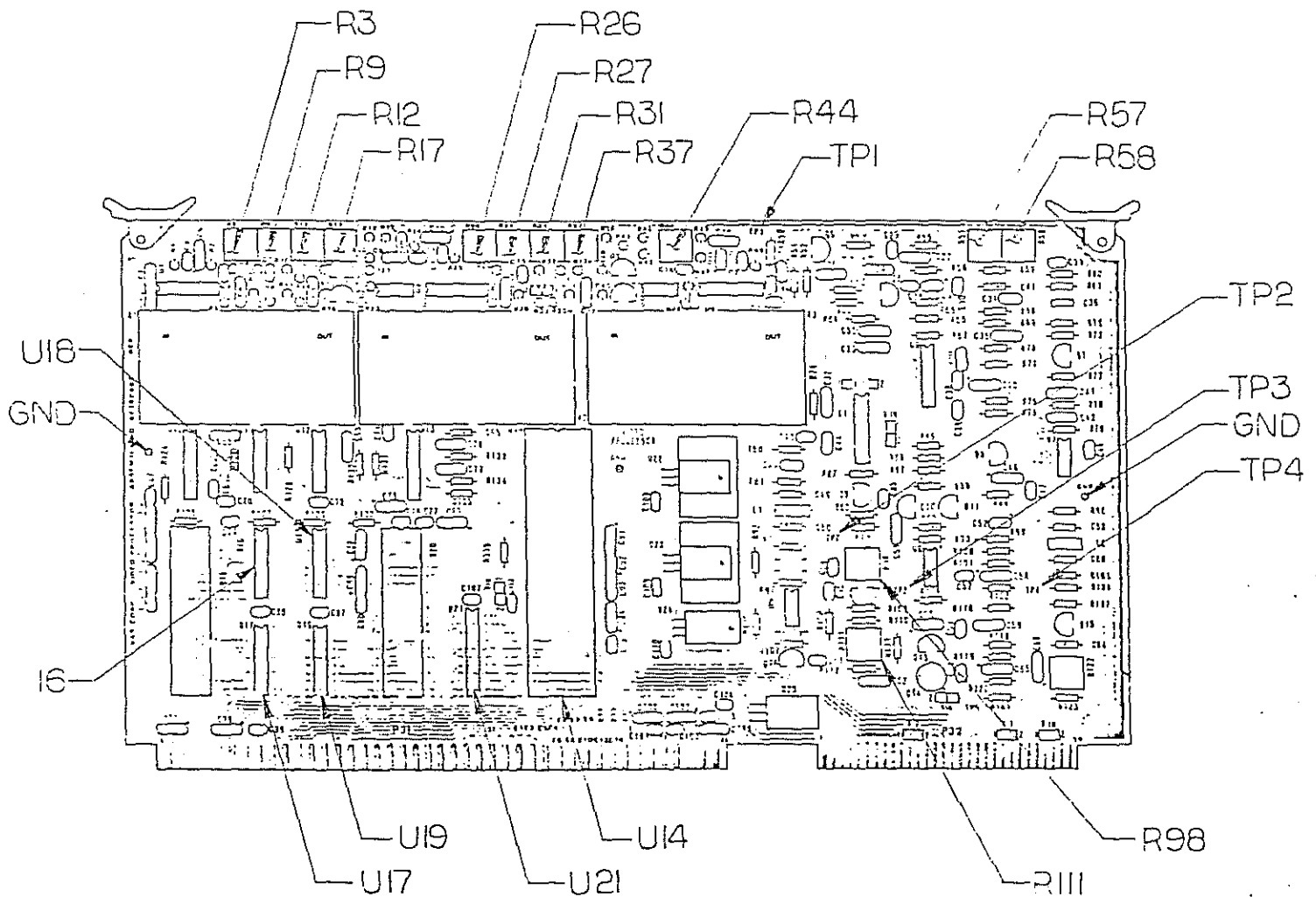
2. Select FLUORO (Press "FL"). Set input to linearity ramp. While watching the output signal on the oscilloscope, increase the input video amplitude until the output begins to clip. Record on both channels. Check the clipping level in ER and FLUORO on each channel.

VIDEO TIMING GENERATOR PHASING

Potential R42 (Phase Lock Loop Phasing) is adjusted for minimum horizontal shift observed on the display monitor during the switch between a live fluoroscopy (FL) and a playback image (ER or LIH).

Test Points

TP1	Bypass Video
TP2	DC Reference
TP3	Composite Sync.
TP4	Record Video (Inverted and scaled)
TP5	Clipped Record Video (A/D input)



VIDEO PROCESSOR BOARD

TROUBLESHOOTING GUIDE

The Troubleshooting Guide presented herein presents failure symptoms, probable causes, and associated corrective actions to be taken; however, a thorough understanding of normal operating procedures and a basic understanding of system architecture is required to evaluate failures and implement corrective action, and proper operation can only be accomplished when the system is correctly installed. For most failures, board replacement or subassembly level exchange is the recommended repair technique. The System Block Diagram and the Functional Block Diagrams presented in Chapter 6 should be utilized for troubleshooting purposes.

SYSTEM INITIALIZATION FAILURES

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Upon power turn-on, the front panel lamps do not light.	AC cord not properly connected Mains input.	Check AC cord connection.
	115/220V switch in wrong position.	Check switch position for proper setting. Switch to other position if appropriate.
	Blown fuse (F1 or F2).	Check/replace fuses.
	Cooling fans not operational.	Check/replace fan(s).
	Loose boards and/or cables.	Check the cable and board seating. (Specifically check System Controller and front panel cable.)
	Power Supply DC outputs (+12V for lamps and +5V for DS 25 track display.	Check/replace fuses in Power Supply and rear panel. If fuses are not blown, replace the power supply.
Upon power turn on, the front panel lamps light but do not go out after the 4-second lamp test. (track displays 000)	System Controller Board circuits not properly installed.	Verify all socketed ICs (U3, U4, U5, and U10 are properly installed. Replace System Controller.
Upon power turn-on, the lamp test passes (refer to Diagnostic Tests) but the Power-up Diagnostics fail.	Battery test failure.	Replace "Memory-Save" battery or System Controller.
	50/60 Hz Test Failure	Power down, switch 50/60 Hz Video Select switch, power up.
Upon power turn-on, the lamp test passes and the power-up diagnostic test passes, but system does not return to the mode selected at power down.	System Controller Board circuits are not properly installed.	Verify all socketed ICs (U3, U4, U5, and U10) are properly installed. Replace System Controller.
	(DS 25 units only) A failure on the Buffer Memory and/or transport subassembly could inhibit power-up initialization or tie up the System Controller. REC/BSY light continues to flash.	A DS 25 unit can operate as a DS 2. (Press the FWD and REV switches simultaneously during power-up.- Replace the Buffer Memory and/or the Winchester Transport Assembly.

SYSTEM OPERATIONAL FAILURES

NOTE

The ability to change parameters via the front panel and light an indicator by pressing a switch verifies that the System Controller is functioning. The System Controller reacts to an input from the front panel during the "main loop" program and lights a lamp as part of the response to the requested change. (The lamp lighting is an echo from the System Controller and not tied directly to the switches.)

(DS 25 ONLY)

The ability to transfer images to and from the disc verifies the operation of the Buffer Memory Board, Transport Subassembly (Disc with Disc Controller Board), the selected Memory and the System Controller. The Arithmetic Logic Unit functions during a record and during a transfer from the selected Memory to Disc.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Fluoroscopy images appear normal; recorded images have very poor contrast.	Video amplitude exceeds range of Video Processor calibration.	Check video source and input termination.
Rolling diagonal lines present on both monitors. (NOTE: The monitors may appear normal in FLUORO.)	The incorrect frame rate was selected at rear panel during power-up. (NOTE: The 50/60 Hz diagnostic doesn't fail if input video is not present during power-up.)	Change position of 50/60 Hz switch.
	A defective Phase Lock Loop Board could cause monitor synchronization problems.	Replace the Phase Lock Loop Board.
Black or white dots are seen on either monitor.	Possible failure in the solid state memory, the ALU Board, or the Motherboard.	Swap Memory Board 1 and Memory Board 2 (DS 25 and DS 2 only). If symptom is now on the other monitor, replace defective Memory Board. If symptom remains on original monitor, replace ALU Board. If symptom still exists, replace the Motherboard.

SYSTEM OPERATIONAL FAILURES

(continued)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Inability to record into either memory, "REC/BSY" lamp does not flash when footswitch or "REC/BSY" switch is pressed.	Defective footswitch and/or interface. System Controller may not be	Replace footswitch and/or interface. Replace System Controller.
Inability to display recorded image or an image or an image transferred to selected memory from the disc. The "REC/BSY" lamp lights once during record and blinks during disc to memory transfer.	The Video Processor has two video outputs. Failures in the playback of a recorded image could be related to one or both video outputs.	Replace Video Processor. Selecting FLUORO ("FL") will verify operation of of all analog circuits.

